REMARKS

Claims 4-7, 10-15 and 17 remain pending in the application with the present amendments. Claims 1-3, 8-9, 16 and 18-20 are canceled herein by the present amendments. In response to the restriction requirement, Applicants confirm the election of the Group 1 claims 1-17 which was provisionally made before, and the non-elected claims 18-20 are canceled herein. Claim 1-3 and 16 are canceled in favor of claim 10, which is amended to incorporate the recitations therein. In the Office Action, the Examiner rejected claims 1-17 under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 6,426,254 B2 to Kudelka et al. ("*Kudelka*") and/or under 35 U.S.C. §103(a) as obvious over U.S. Patent No. 6,660,582 B2 to Birner et al. ("*Birner*"). For the reasons set forth below, Applicants respectfully submit that the presently amended claims are fully distinguished over *Kudelka*. Reconsideration and allowance of the pending claims is requested.

As recited in amended claim 10 herein, from which all other pending claims depend, a method is provided of forming a trench capacitor on a semiconductor substrate. The method includes forming a pad stack on a semiconductor substrate and then forming a hard mask over the pad stack. The hard mask and the pad stack are then patterned to form an opening. Thereafter, the substrate is vertically etched through the opening to form a trench, and the sidewalls of the trench are thereafter horizontally widened. In addition, the sidewalls of the opening in the pad stack are widened relative to the hard mask such that the *hard mask overhangs the sidewalls of the opening in the pad stack and the widened sidewalls of the trench*. Thereafter, a sacrificial collar is formed on the widened sidewalls of the trench and the trench is vertically deepened to

create a lower portion extending below the sacrificial collar. A capacitor is then formed in the lower portion.

Thus, amended claim 10 requires that steps be performed in order: 1) a substrate is etched through an opening in a hard mask and a pad stack to form a trench; 2) the sidewalls of the trench are widened; and sidewalls of the opening in the pad stack are widened relative to the hard mask such that the hard mask overhangs the widened sidewalls of the opening in the pad stack and the widened sidewalls of the trench; 3) a sacrificial collar is formed on the widened sidewalls of the trench; and 4) the trench is vertically deepened to create a lower portion extending below the sacrificial collar.

By contrast, the invention as recited in claim 10 is neither taught nor suggested by *Kudelka* or by the combination of *Kudelka* with *Birner*. *Kudelka* merely describes a method of widening a trench, but not the performance of other steps in such way as recited in claim 10. The passage of *Kudelka* (col. 4, lns. 29-46) cited by the Examiner to reject claims 1 and 10 merely describes a method of widening the entire trench through a wet etch process. *Kudelka* neither teaches nor suggests a process as recited in claim 10 in which, *after the trench is widened*, steps are subsequently done to form a sacrificial collar on the widened sidewalls and to vertically deepen the trench to create a lower portion extending below the sacrificial collar.

Moreover, other features recited in the claims are neither taught nor suggested by *Kudelka*. *Kudelka* neither teaches nor suggests the feature recited in claim 5 of widening the trench using a chemistry including an HNO_3/HF mixture. (Cf. col. 5, ln. 61 through col. 6, ln. 12). *Kudelka* also neither teaches nor suggests that the hard mask is

formed of a TEOS deposited oxide layer or a BSG deposited oxide layer. The passage of *Kudelka* (col. 4, ln. 53 to col. 5, ln. 3) cited by the Examiner in rejecting claim 12 merely describes forming a TEOS *collar* in the trench, not a hard mask.

Moreover, *Birner* neither teaches nor suggests the features of the invention which *Kudelka* lacks with respect to the presently claimed invention. The passage of *Birner* (col. 8, lns. 10-32) cited by the Examiner does not describe widening sidewalls of an opening in a pad stack relative to a hard mask. In fact, *Birner* does not teach etching through an opening in both a hard mask and a pad stack. *Birner* merely teaches *one* etching mask layer 100 (col. 8, lns. 5-7) disposed over the semiconductor substrate. Moreover, the process described in *Birner* does not result in one in which a hard mask overhangs the widened sidewalls of an opening in a pad stack, because Birner teaches only *one* etching mask layer 100.

Accordingly, in view of the amendments and remarks herein, it is believed that all claims of the application are now in condition for allowance. However, if for any reason the Examiner does not believe that such action can be taken at this time, the Examiner is requested to telephone the Applicants' attorney at the number indicated below to discuss any issues that may remain.

It is believed that no fee is due in connection with the filing of this Amendment. However, if any fee is due, authorization is granted to debit the Deposit Account No. 09-0458 of the Assignee. If there is an overpayment, please credit the same account.

Dated: November 4, 2004

Respectfully submitted,
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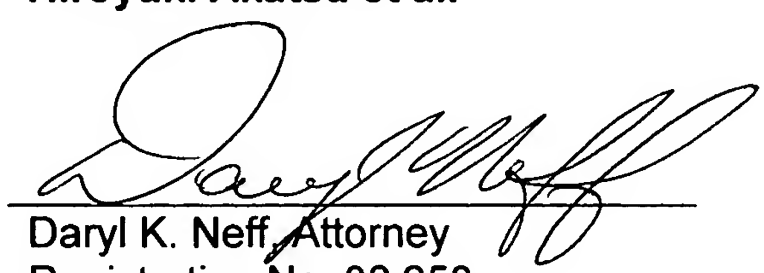
By: 

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